

AIR CIRCUIT CYL & PIPELINE INSTALLATION FOR NARKOMED ANESTHESIA SYSTEMS

INSTALLATION PROCEDURE

NOTE: Refer to Drawing Numbers S010098 and S4109715 for kit information.

1. Turn the System Power switch to ON and disconnect all pipeline hoses.
2. Close all cylinder valves except the O₂ cylinder valve.
3. Set the oxygen flow rate to 5 L/min.
4. Open the N₂O flow control valve to drain pressure from the system.
5. Close the O₂ cylinder valve, and close the flow control valves. Press the O₂ FLUSH button to drain oxygen pressure from the system.
6. Turn the System Power switch to STANDBY and remove AC power from the machine.
7. Remove the screws securing the table top, and remove the top.
8. Remove the flowmeter housing back cover.
9. Remove the vapor box front cover.
10. Remove the vapor box back cover.
11. From the rear of the flowmeter housing, remove the screws holding the angled front plate at the top of the flowmeter shields, and remove the plate.
12. Remove the shields over the O₂ and N₂O flowmeters.

NOTE: On later machines with a one-piece flowmeter shield, the oxygen flow control knob and the knob guard must also be removed.

INSTALLATION PROCEDURE (continued)

13. Remove the two screws holding the center channel of the flowmeter assembly, and remove the channel.

Remove flowmeter lights PCB and channel from the mounting studs. Disconnect the wire harness at the top of the assembly, and place the assembly on a static mat.

14. Attach a new instruction label to the inside bottom of the top cabinet drawer as shown in Figure 1.

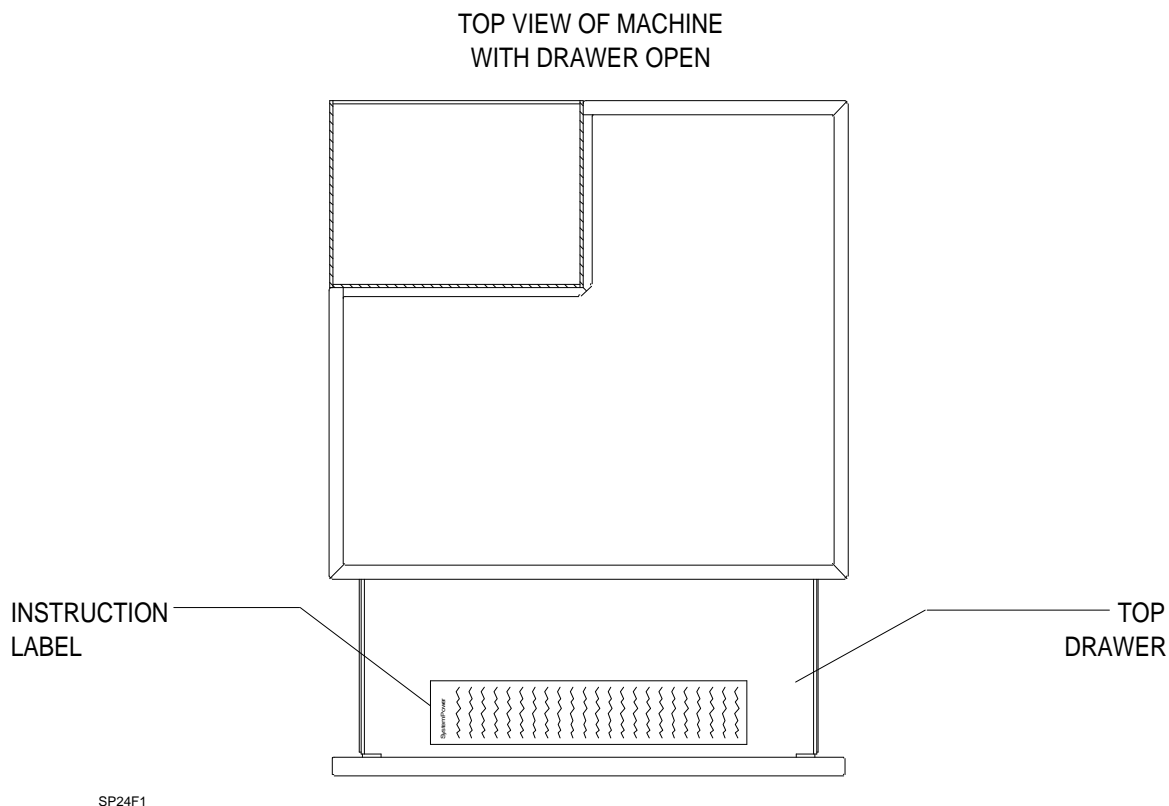


Figure 1: NEW INSTRUCTION LABEL LOCATION

INSTALLATION PROCEDURE (continued)

15. Mount the cylinder support on the bottom frame rail at the back of the machine (see Figure 2) using two ¼-20 x 2½ in. hex head screws, lock washers and flat washers.

NOTE: Later model machines have the cylinder support and yoke spacer in place.

16. Mount the air yoke and spacer block on the upper frame rail of the machine as shown in Figure 2. Use two 5/16-24 x 3/4 in. socket head screws and lock washers. Ensure that the yoke has a "AIR" label.

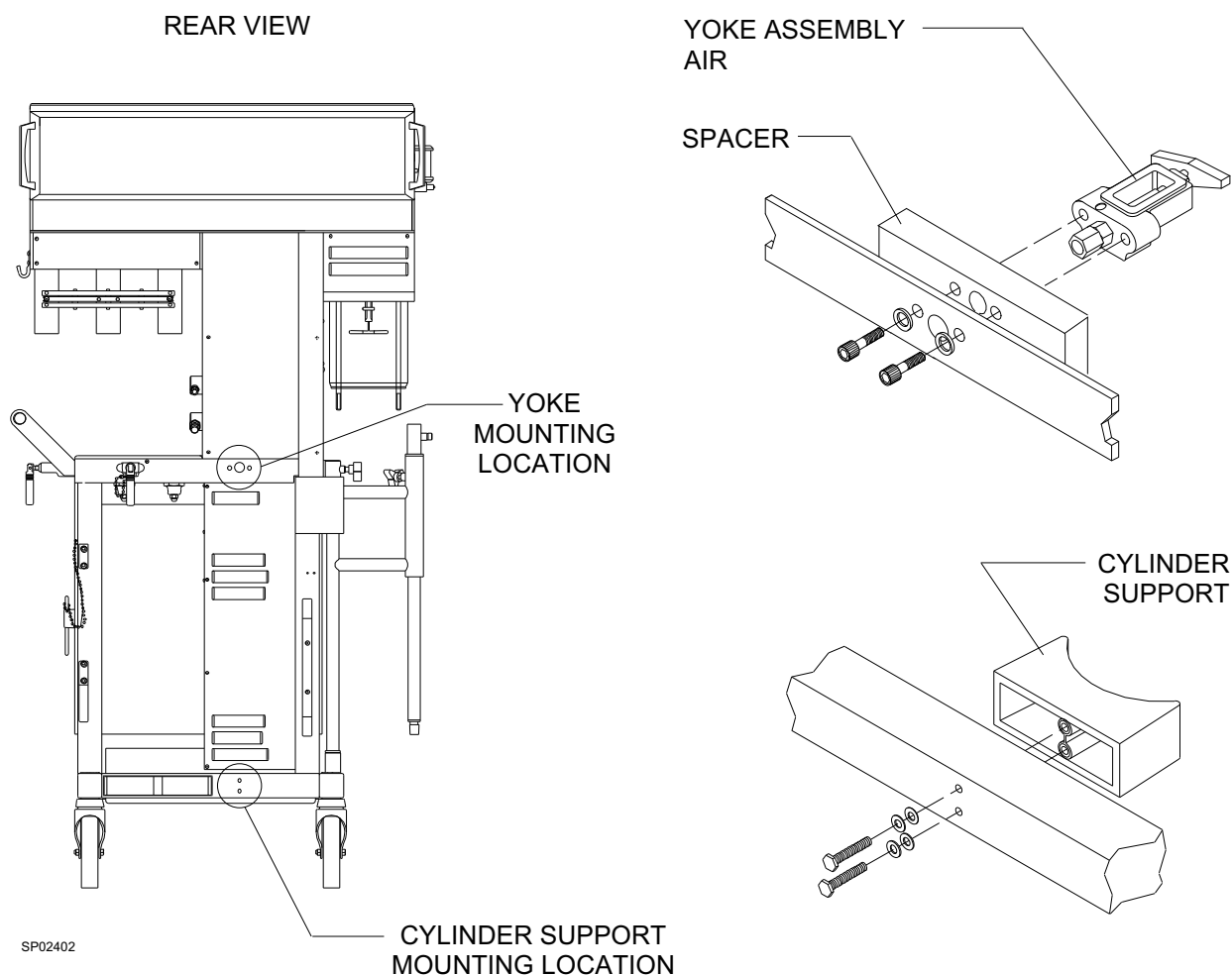


Figure 2: AIR YOKE AND CYLINDER SUPPORT MOUNTING LOCATIONS

INSTALLATION PROCEDURE (continued)

17. Position the air cylinder pressure regulator assembly as shown in Figure 3, with the Inlet marking toward the front of the machine.
18. Install two 10-32 x ½ in. set screws in the regulator mounting bracket and tighten them.
19. Connect a 3/16 in. dia. (P/N 4104215) pre-bent copper tube between the air cylinder yoke and the inlet fitting on the air cylinder regulator. Ensure that the tubing is inserted ferrules correctly, and tighten the fittings securely. Install a "AIR" label on each end of this tube.

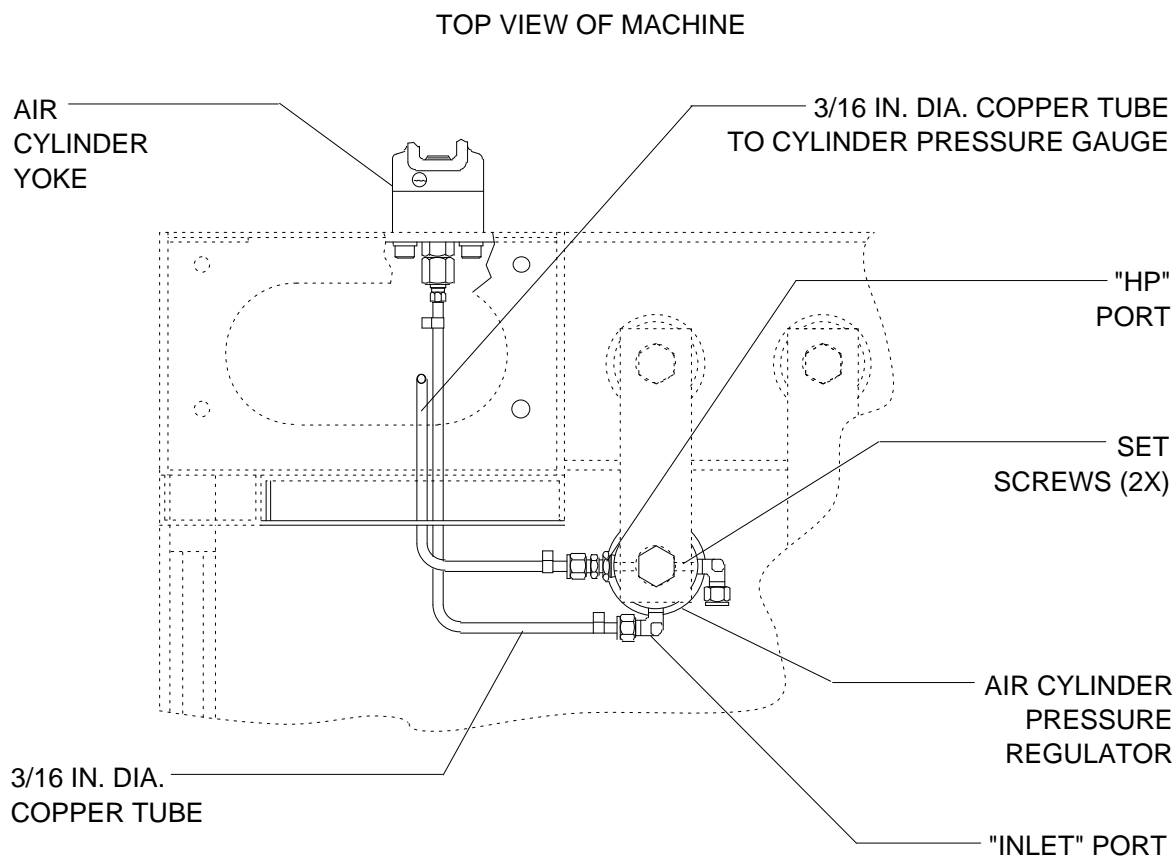


Figure 3: AIR CYLINDER REGULATOR MOUNTING AND H.P. CONNECTIONS

INSTALLATION PROCEDURE (continued)

20. Place an air pipeline gauge assembly into the upper hole of the gauge channel labeled "Air" Pipeline, and secure it with two 10-32 kep nuts and flat washers. See figure 4.
21. Place an air cylinder gauge assembly into the lower hole of the gauge channel labeled "Air" Cylinder and secure it with two 10-32 kep nuts and flat washers.
22. Connect a 3/16 in. dia. (P/N 4104214) pre-bent copper tube between the air cylinder gauge and the port marked "HP" on the air cylinder regulator. Ensure that the tubing is inserted correctly, and tighten the fittings securely. Install a AIR label on each end of this tube.
23. Install gauge covers on the air pipeline and cylinder gauges.

NOTE: On later machines with a one-piece 3-gas flowmeter sub-assembly, gauge covers are not used.

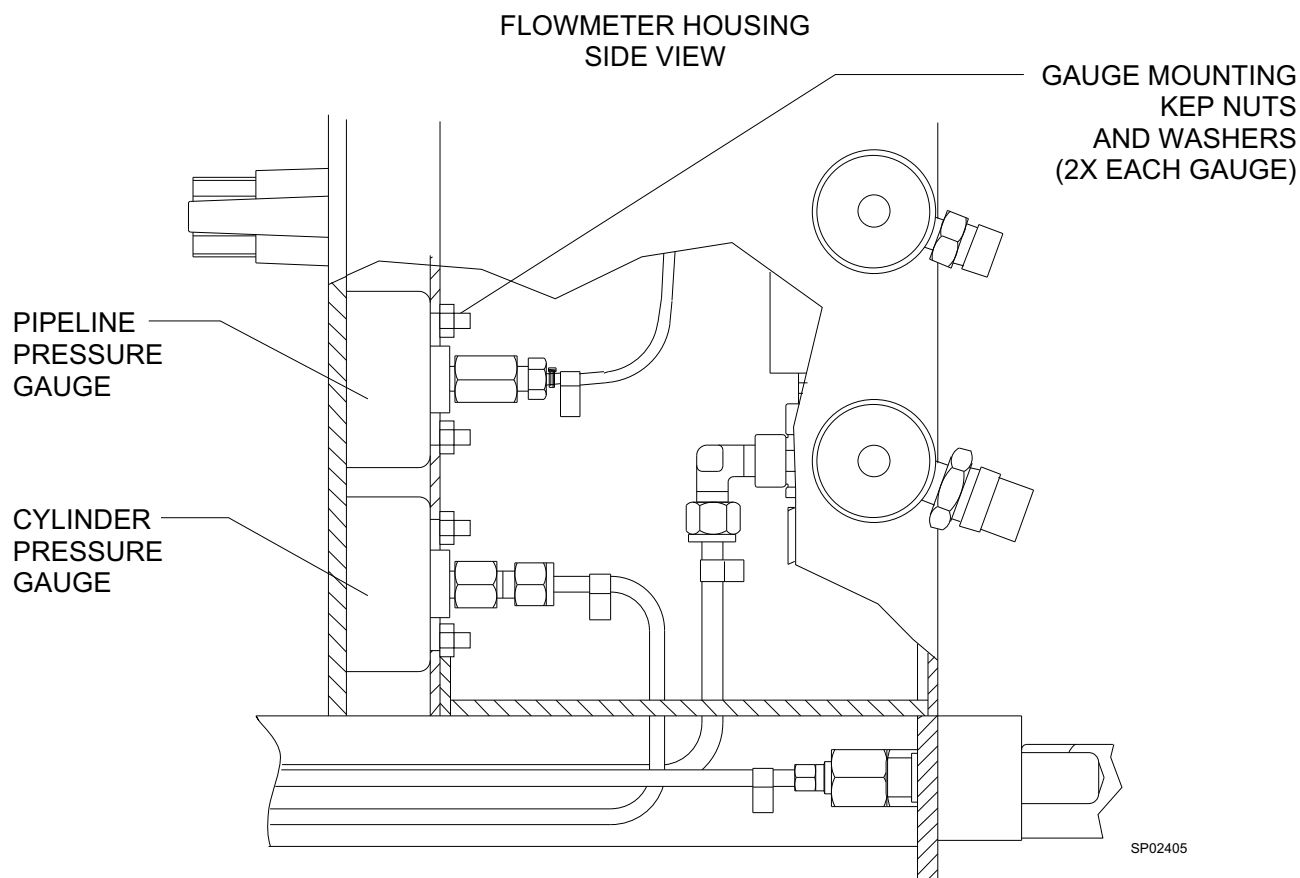


Figure 4: AIR CYLINDER AND PIPELINE GAUGE MOUNTING

INSTALLATION PROCEDURE (continued)

24. Remove the 3/4 in. plastic plug from the flowmeter housing directly above the O₂ pipeline inlet assembly.
25. Install a DISS air inlet housing in the hole where the plug was removed, using a 5/8-18 hex nut and lock washer. Orient the DISS connection at a 70° angle as shown in Figure 5. Ensure that the housing has a AIR label.
26. Install the filter assembly in the air inlet housing using a small amount of Loctite #271 (red) on the threads.
27. Install the tee fitting (P/N 4102760) as shown in Figure 5, with its side port facing downward.

Use a small amount of Loctite #271 (red) on the threads.

28. Install a 1/8 NPT x 1/16 in. (P/N 4111771) hose barb fitting in the tee as shown in Figure 5. Use a small amount of Loctite #271 (red) on the threads.

29. Install a 1/4 in. tube to 1/8 NPT (P/N 4109410) ell fitting in the remaining port in the tee as shown in Figure 5. Use a small amount of Loctite #271 (red) on the threads.

NOTE: Remove the ferrule and nut before installing the fitting.

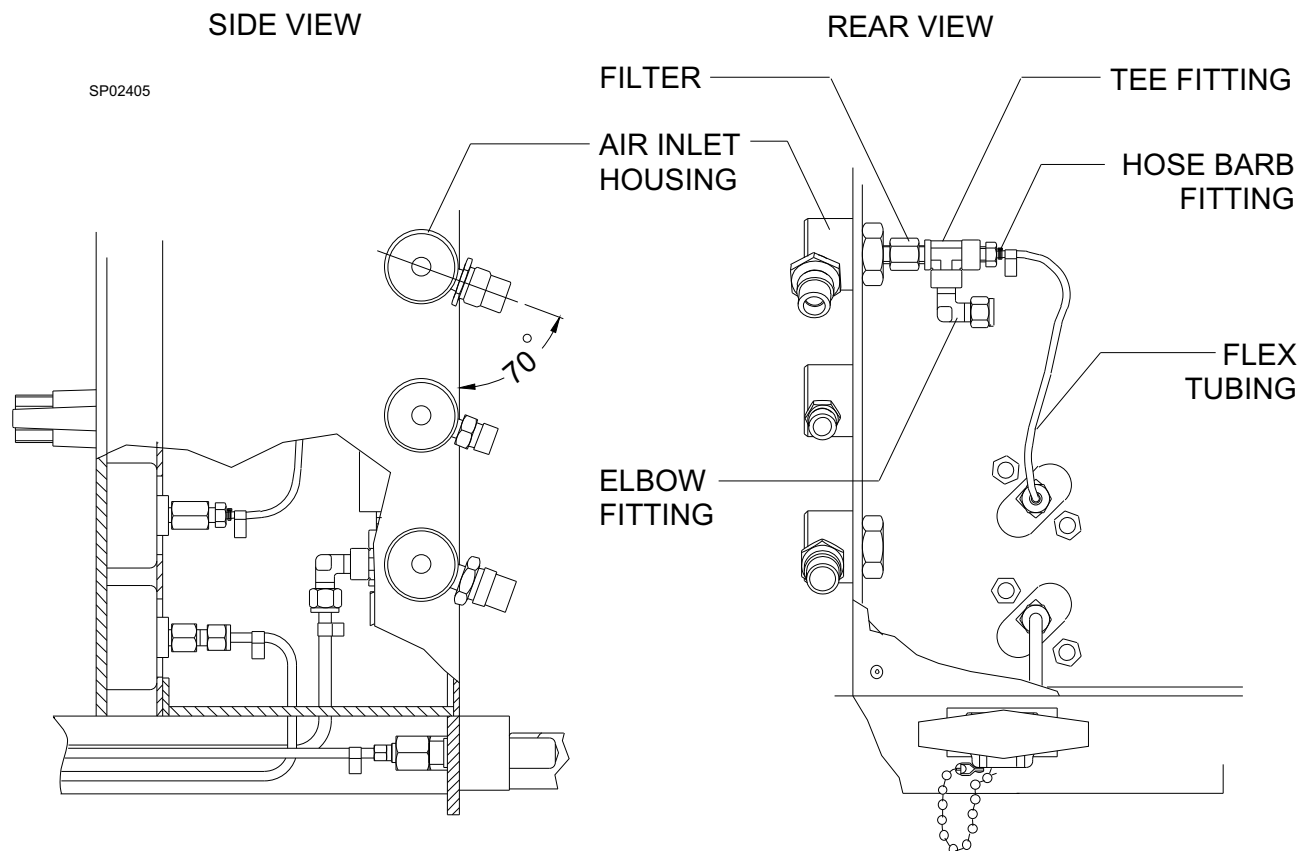


Figure 5: AIR PIPE LINE INLET ASSEMBLY

INSTALLATION PROCEDURE (continued)

30. Install an 8 in.length of flex tubing between the air pipeline gauge and the hose barb fitting that was previously installed. Secure both ends of the tubing with press-on hose clamps, and install a "AIR" label on each end of this tube.

NOTE: Perform Steps 31 and 32 if machine is configured with the N₂O failsafe connected to the O₂ low pressure alarm switch.

31. Remove the three wires connected to the O₂ low pressure alarm switch, and remove the alarm switch assembly by disconnecting the fittings indicated in Figure 6.

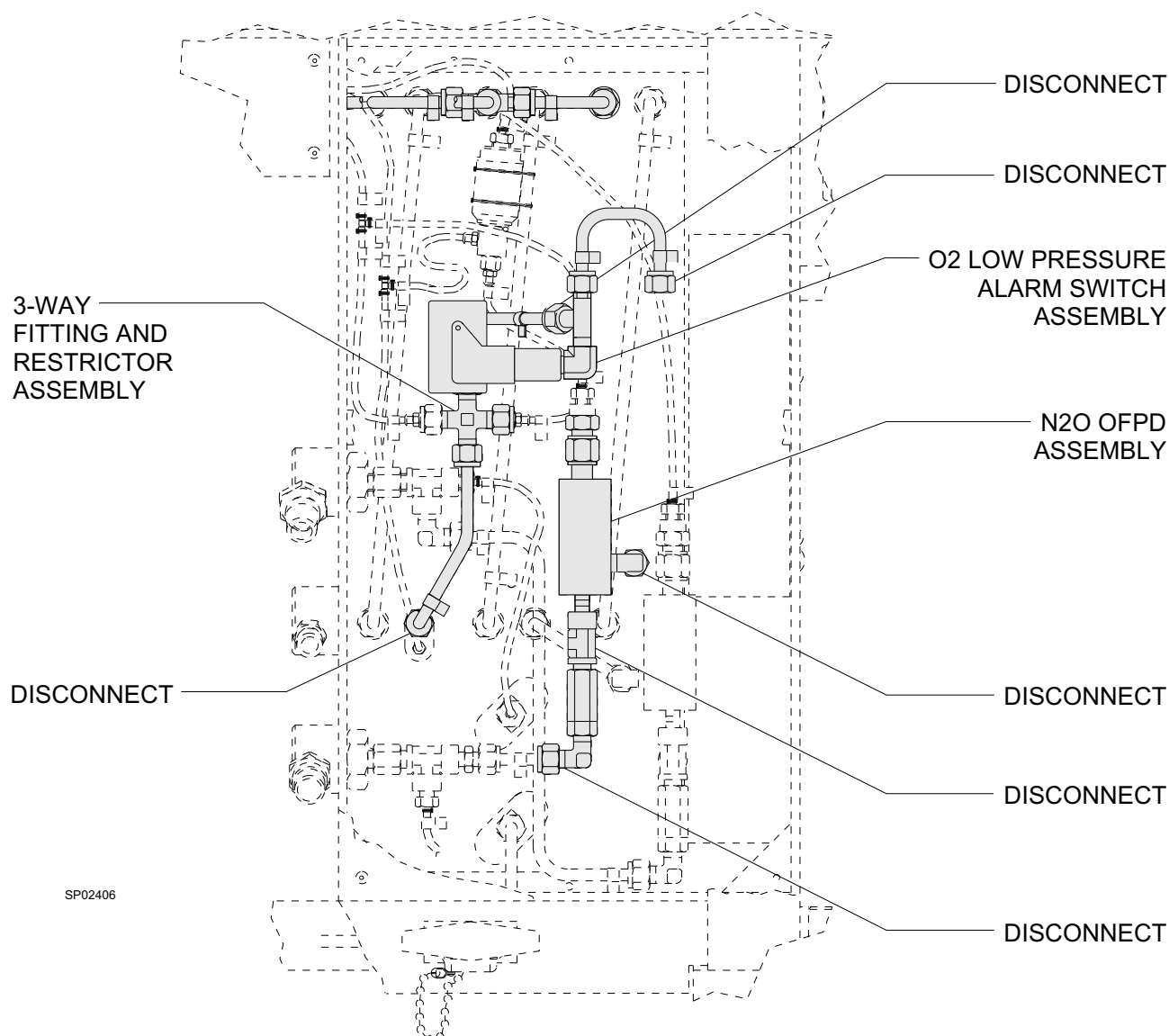


Figure 6: ASSEMBLIES TO BE REMOVED

INSTALLATION PROCEDURE (continued)

32. Remove the N₂O OFPD (failsafe) assembly by disconnecting the fittings indicated in Figure 6.

Carefully disconnect the flex tubing at the top of the assembly.

NOTE: Skip Step 33 if machine is configured with a 4-way fitting.

33. Remove the 3-way fitting and restrictor assembly by disconnecting the fitting at the O₂ flowmeter inlet. DO NOT disturb the lower tube connection at the 3-way fitting. Carefully disconnect the flex tubing connections.

34. Remove the manifold assembly connected to the O₂ and N₂O outlets at the top of the flowmeters.

NOTE: Skip the next three steps for later machines with a one-piece 3-gas flowmeter sub-assembly.

35. Remove the ¼ in.dia. "U" tube from the air flowmeter channel assembly.

36. Install the air flowmeter channel and secure it with an 8-32 x ¼ in. socket head screw and lock washer.

37. Replace the ¼ in.dia. "U" tube from the bottom left to the top right fittings on the air flowmeter channel. Tighten the ferrule fittings securely.

INSTALLATION PROCEDURE (continued)

38. Install a ¼ in.dia. "L" tube (P/N 4110837-004) between a 4-way fitting (P/N 4102772) and the N₂O flowmeter outlet as shown in Figure 7.

Do not tighten the fittings. Install a N₂O label on each end of this tube.

39. Install a ¼ in.dia. "L" tube (P/N 4110837-004) between the 4-way fitting and the O₂ flowmeter outlet as shown in Figure 7. Do not tighten the fittings. Install a O₂ label on each end of this tube.

40. Install a ¼ in.dia. straight tube (P/N 4110834-004) between the 4-way fitting and the air flowmeter outlet as shown in Figure 7. Install a AIR label on this tube. Tighten these connections and all those that were made in the previous two steps.

41. Install a ¼ in.dia. (P/N 4104204) pre-bent copper tube between the remaining port on the 4-way fitting and the vapor block inlet. Tighten the fittings and install a "MIX" label on this tube. A top view of the manifold arrangement is shown in Figure 7.

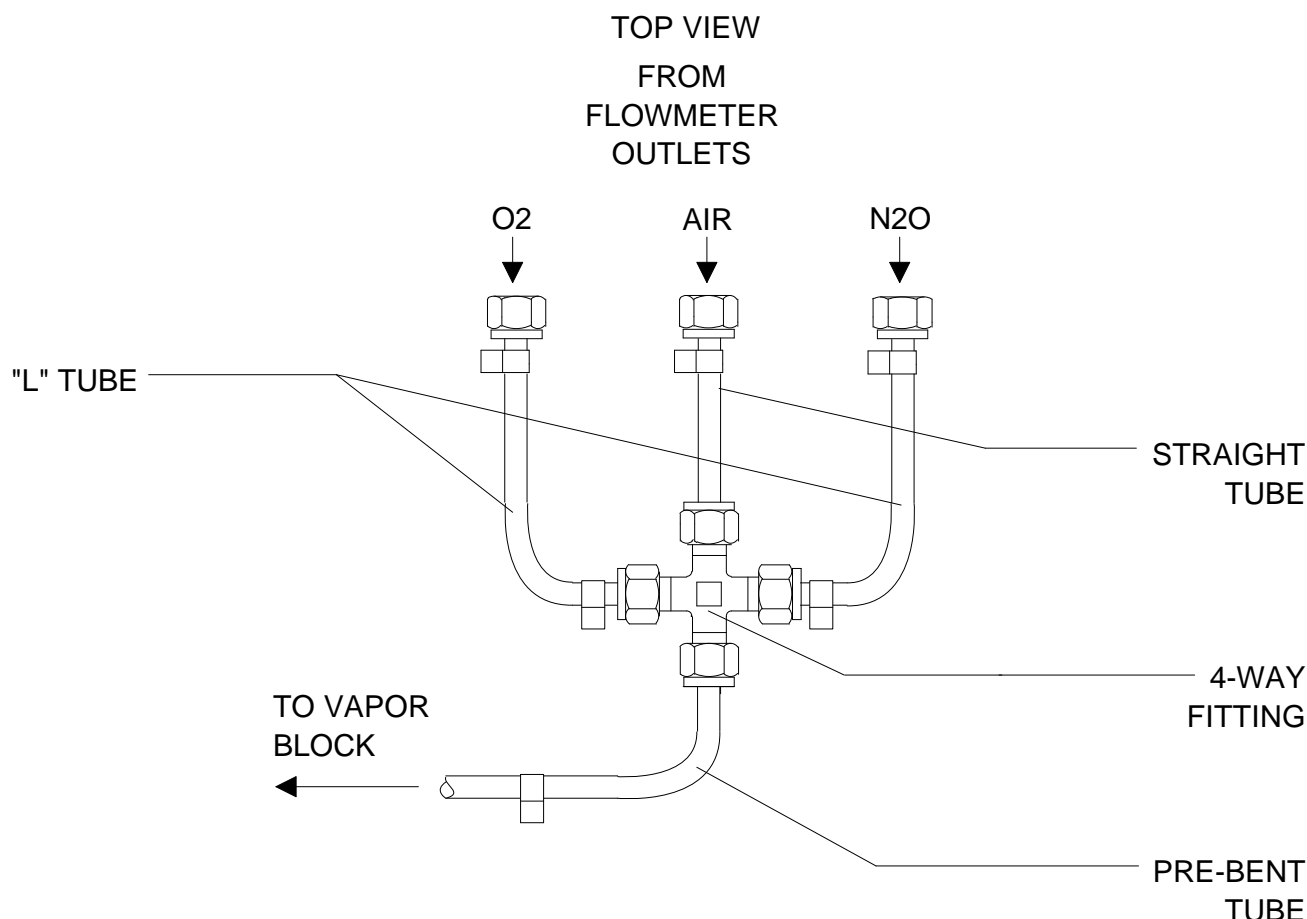


Figure 7: THREE-GAS MANIFOLD ASSEMBLY

INSTALLATION PROCEDURE (continued)

42. If the wiring was previously removed from the O₂ low pressure alarm switch, connect the wires to the switch as follows:
Orange to COM
Brown to N.O.
White/Orange to N.C.
43. Install the 4-way fitting and restrictor assembly (ref. Figure 6) by connecting its lower tube to the O₂ flowmeter inlet.
44. Reinstall the O₂ pressure switch assembly by joining the upper tube of the 4-way fitting to the tee fitting on the switch assembly.
45. Join the upper tube of the O₂ pressure switch assembly to the tee fitting connected to the system power switch assembly. Tighten the fittings.
46. Connect a ¼ in.dia.(P/N 4110837-015) "L" tube to the air cylinder pressure regulator as shown in Figure 8. Install a "AIR" label on each end of this tube.
47. Connect the other end of the "L" tube to a ¼ in. tee fitting (P/N 4108636), and install a plug in the side port of the tee fitting.
48. Connect the short end of a ¼ in.dia. (P/N 4109512) pre-bent tube to the remaining port on the tee fitting as shown in Figure 8. Install a "AIR" label on each end of this tube.
49. Connect a ¼ in.dia. (P/N 4110836-004) "S" tube to the air flowmeter inlet. See Figure 9.

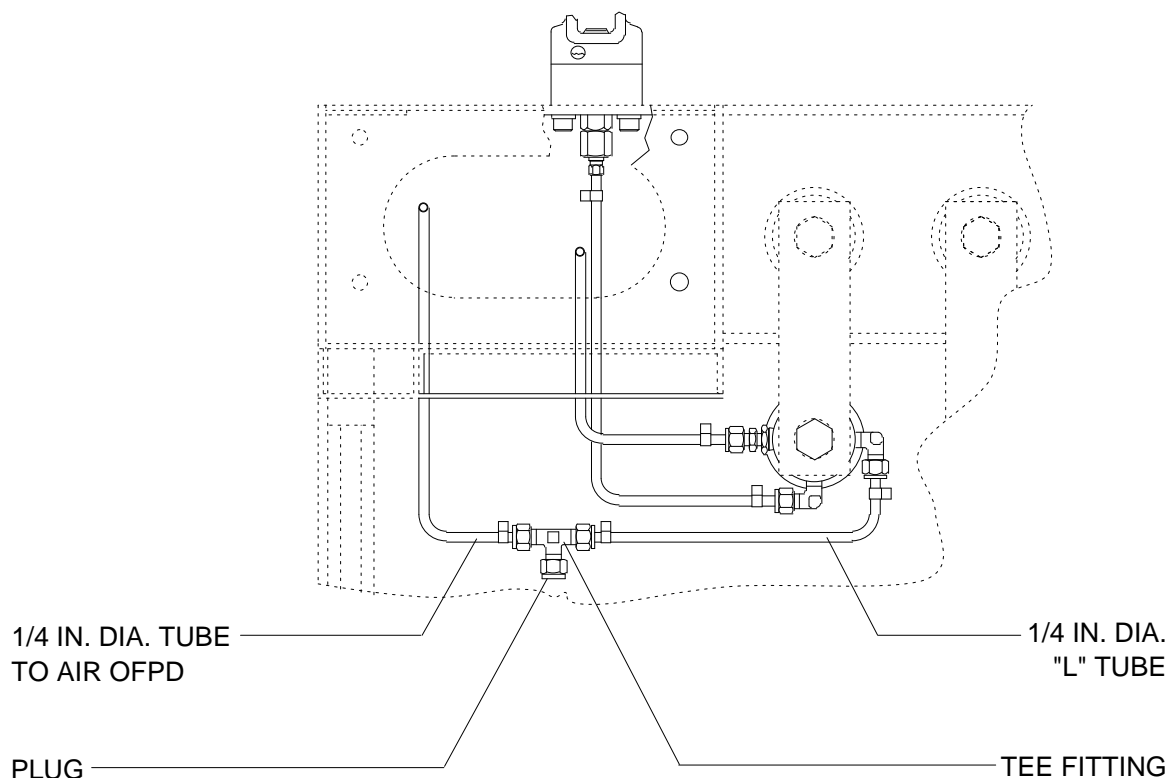


Figure 8: AIR CYLINDER REGULATOR L.P. CONNECTIONS

INSTALLATION PROCEDURE (continued)

50. Position the air OFPD assembly in the flowmeter housing, and connect the other end of the "S" tube to the side fitting on the OFPD. Install a "AIR" label on each end of this tube.
51. Connect the tube from the air cylinder pressure regulator to the elbow fitting directly under the air OFPD and facing the front of the machine as shown in Figure 9.

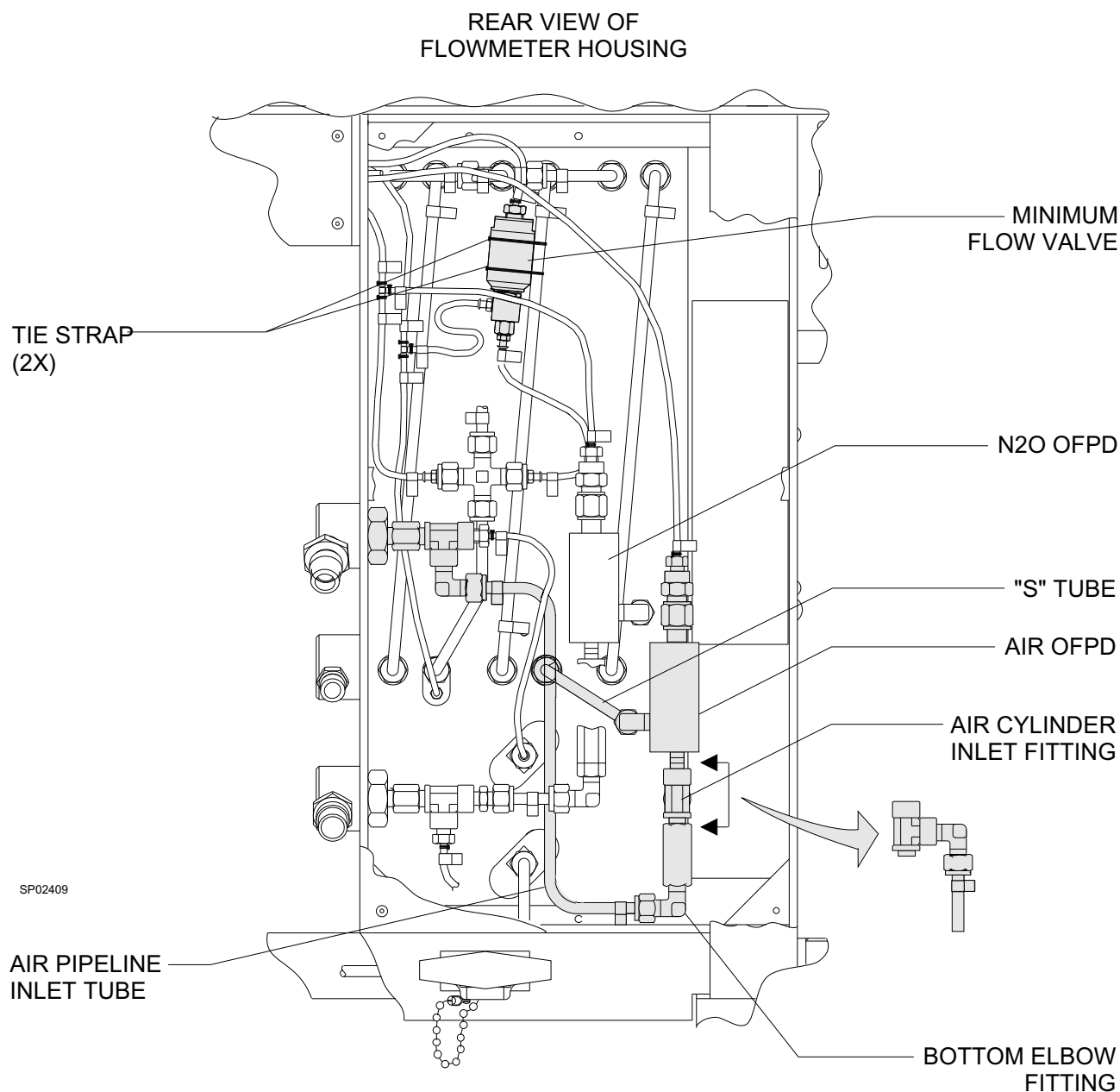


Figure 9: AIR OFPD AND MINIMUM FLOW VALVE INSTALLATION

INSTALLATION PROCEDURE (continued)

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| <p>52. Install a ¼ in.dia. (P/N 4108688) pre-bent tube between the pipeline inlet assembly and the bottom elbow fitting on the air OFPD as shown in Figure 9. Install a AIR label on each end of this tube.</p> <p>53. Position the N₂O OFPD assembly in the flowmeter housing, and connect the side fitting of the OFPD assembly to the tube leading to the ORMC assembly inlet in the vapor box (or to the flowmeter inlet if machine is equipped with an ORM assembly).</p> | <p>54. Connect the tube from the N₂O regulator to the fitting at a 45° angle directly under the N₂O OFPD.</p> <p>55. Connect the tube from the N₂O pipeline inlet assembly to the bottom fitting on the N₂O OFPD assembly. Tighten all N₂O OFPD fittings.</p> <p>56. Attach the minimum flow cutoff valve to the air flowmeter "U" tube with two tie straps as shown in Figure 9.</p> |
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INSTALLATION PROCEDURE (continued)

57. Mount the gas selector valve assembly to the floor of the vapor box, oriented as shown in Figure 10, with two 10-32 x 5/16 in. socket head screws, lock washers and flat washers.
58. Attach the pressure switch assembly to the copper tubing in the vapor box with two tie straps as shown in Figure 10.
59. Join the wire harness connectors from the alarm channel and the ORMC to the pressure switch assembly as shown in Figure 10.
60. Install a 16 in. length of flex tubing between the right side port of the pressure switch and the front port on the gas selector assembly. Secure each end of the tubing with a press-on clamp. Install a O₂ label on each end of this tube as shown in Figure 10.
61. Connect a 10½ in. length of flex tubing to the side port of the front valve on the gas selector, and secure it with a press-on clamp. Connect the other end of the tubing to a nylon tee fitting and secure it with a tie strap. Install a O₂ label on each end of this tube as shown in Figure 10.

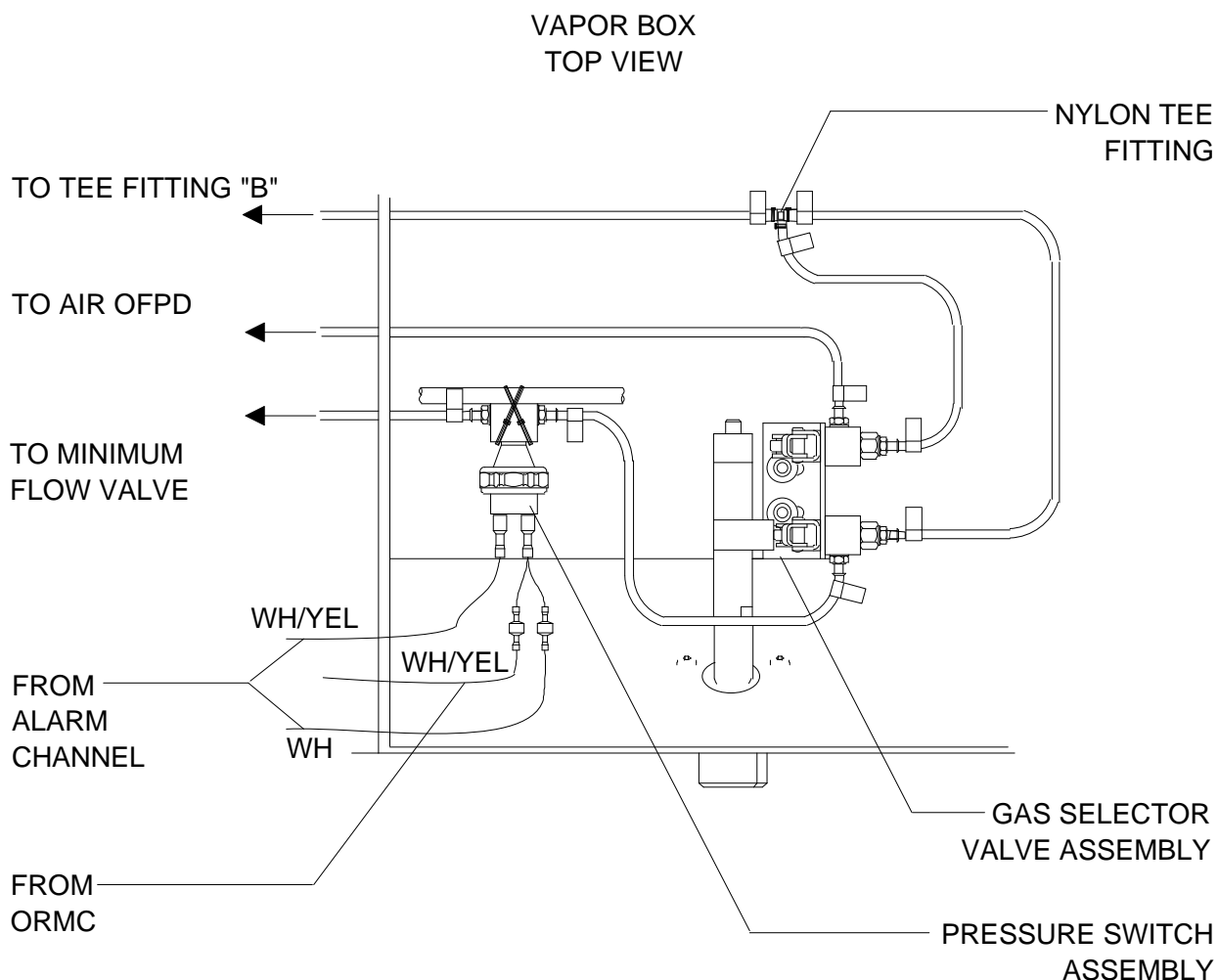


Figure 10: GAS SELECT VALVE AND PRESSURE SWITCH CONNECTIONS

INSTALLATION PROCEDURE (continued)

62. Connect an 8 in. length of flex tubing from the side port of the rear valve on the gas selector and secure it with a press-on clamp.

Connect the other end of the tubing to the center port of the nylon tee fitting, and secure it with a tie strap. Install a green O₂ label on each end of this tube.

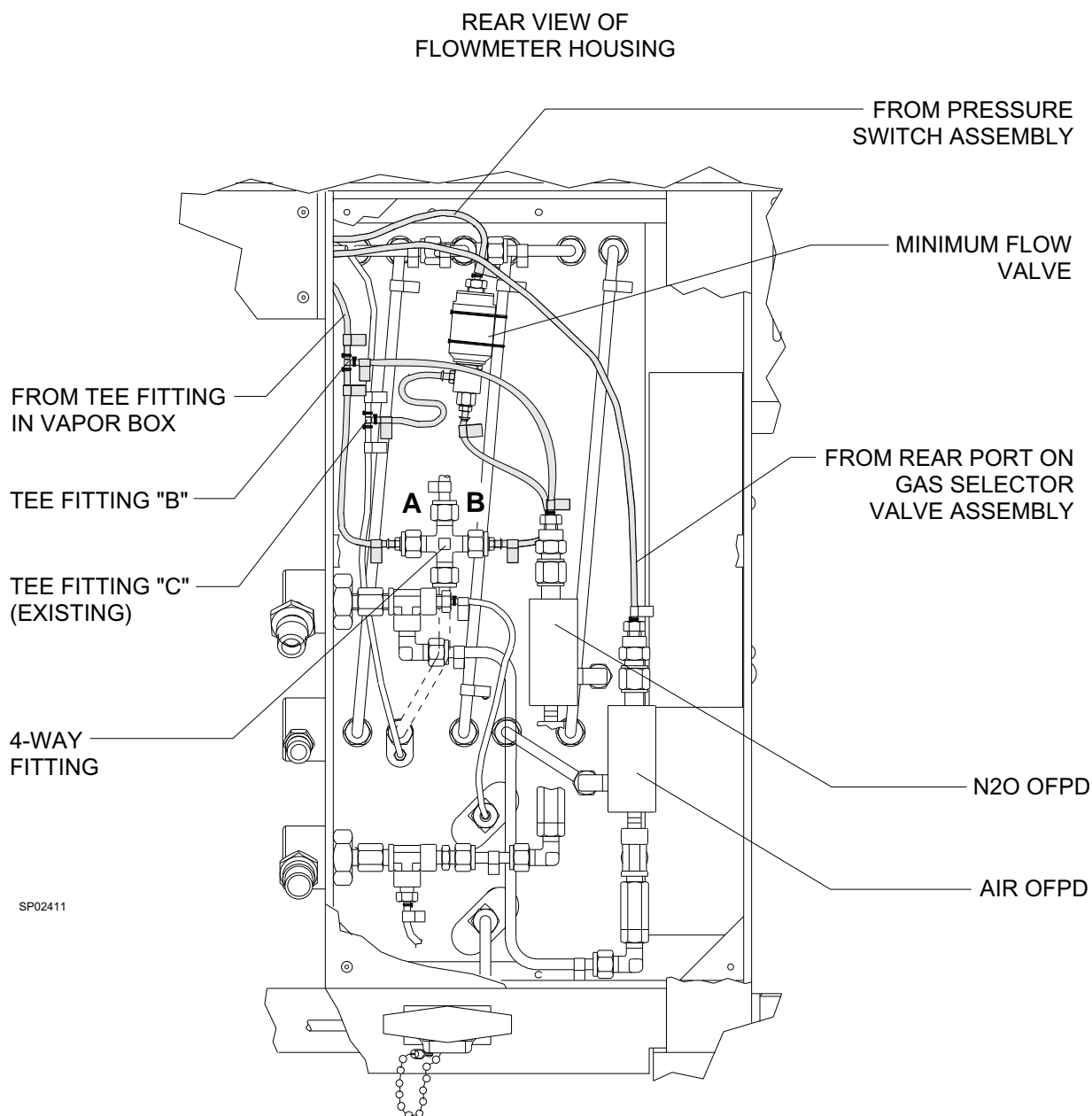


Figure 11: FLEX TUBING CONNECTIONS

INSTALLATION PROCEDURE (continued)

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| <p>63. Connect a 24 in. length of flex tubing from the rear port on the gas selector assembly to the hose barb on the top of the air OFPD in the flowmeter housing. See Figures 10 and 11. Secure the valve end with a press-on clamp, and a tie strap on the OFPD. Install a O₂ label on each end of this tube.</p> <p>64. Connect a 13½ in. length of flex tubing to the left side port of the pressure switch in the vapor box, and secure it with a press-on clamp. Connect the other end of the tubing to the top hose barb on the minimum flow valve, and secure it with a press-on clamp. Install a O₂ label at each end of this tube.</p> <p>65. Connect a 12 in. length of flex tubing from the remaining port of the nylon tee fitting in the vapor box to the top of nylon tee fitting "B" in the flowmeter housing. See Figure 11. Secure each end of the tube with a tie strap, and install a O₂ label at each end of the tube.</p> <p>66. Connect a 5 in. length of flex tubing to the bottom of nylon tee fitting "B" and secure it with a tie strap. Connect the other end of the tubing to side port "A" on the 4-way fitting. See Figure 11. Secure this end with a press-on clamp, and install a O₂ label at each end of the tube.</p> <p>67. Connect an 8 in. length of flex tubing to the top port on the N₂O OFPD and secure it with a press-on clamp. Connect the other end to the remaining port on nylon tee fitting "B" and secure it with a tie strap. Install a O₂ label at each end of this tube.</p> <p>68. Connect an 8 in. length of flex tubing from side port "B" on the 4-way fitting to the bottom port of the minimum flow valve, and secure the connection with a press-on clamp. See Figure 11. Install a O₂ label at each end of this tube.</p> | <p>69. Connect a 7 in. length of flex tubing to the side port of nylon tee fitting "C", and secure it with a tie strap. Connect the other end of the tubing to the side port of the minimum flow valve, and secure it with a press-on clamp. Install a O₂ label on each end of this tube.</p> <p>70. Inspect the existing flex tubing between the O₂ flow control valve and the bottom port on nylon tee fitting "C", and ensure that each end is properly secured.</p> <p>71. Inspect the existing flex tubing between the top port on nylon tee fitting "C" and the ORMC/ORM assembly. Ensure that each end is properly secured.</p> <p>72. Assemble the gas selector switch cam assembly to the new vapor box front panel with two 8-32 x 3/8 in. socket head screws and lock washers. See Figure 12.</p> <p>73. Install the vapor box front panel and ensure that the selector switch cams operate the gas select valves correctly.</p> <p>74. Open one cylinder valve each of Oxygen, Nitrous Oxide, and Air.</p> <p>75. Connect AC power to the machine and turn the System Power switch to ON.</p> <p>76. Remove the oxygen fine flowmeter tube from its channel by turning the upper flow tube retainer counter-clockwise with a cut down 5/32 allen key.</p> <p>77. Open the oxygen flow control valve fully counter-clockwise to flush out any debris in the new piping system.</p> |
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INSTALLATION PROCEDURE (continued)

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| <p>78. Carefully reinstall the flowmeter tube and ensure that all gaskets and O-rings are properly installed, and that the tube is oriented with its markings facing forward.</p> | <p>81. Replace the flowmeter shield(s). Replace the oxygen flow control knob and the knob guard on later machines with a one-piece flowmeter shield.</p> |
| <p>79. Repeat the procedure given in Steps 76 thru 78 for all of the other flow tubes.</p> | <p>82. Replace the angled front plate at the top of the flowmeter shields.</p> |
| <p>80. Replace the flowmeter lights PCB. (The black wire is connected to the terminal at the back of the PCB.)</p> | <p>83. Close all cylinder valves and drain the pressure from the system.</p> |
| | <p>84. Proceed to the Adjustment and Test section.</p> |

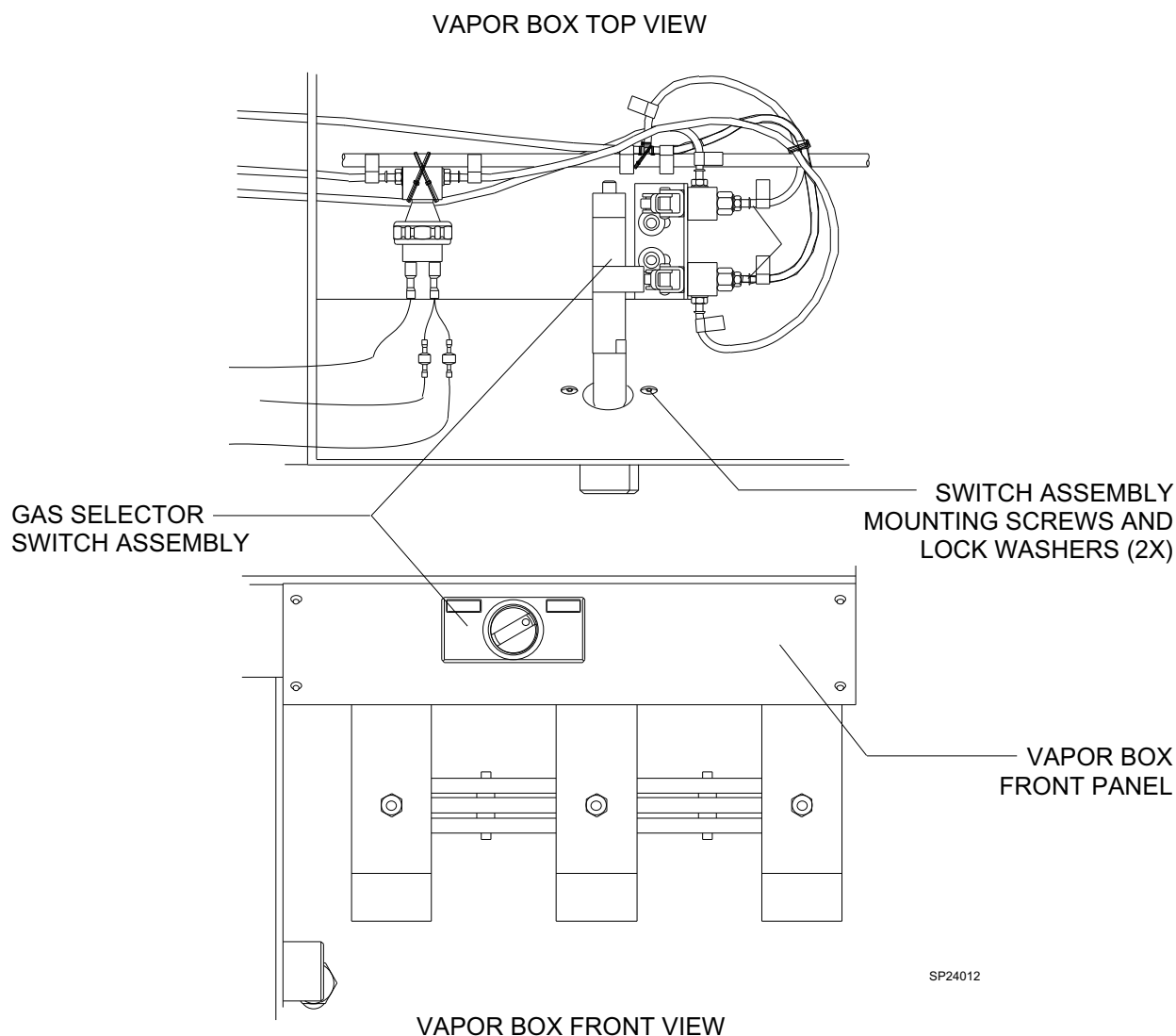


Figure 12: GAS SELECTOR SWITCH ASSEMBLY

OXYGEN SUPPLY PRESSURE ALARM

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| <ol style="list-style-type: none"> 1. Remove the plug from the O₂ cylinder pressure regulator output line, and connect a test gauge (#S000063) to the tee fitting. 2. Attach an oxygen cylinder to the oxygen yoke on the machine. 3. Open the oxygen cylinder valve and set the oxygen flow rate to 1 l/min. 4. Close the oxygen cylinder valve. 5. As the pressure drops, the oxygen supply pressure alarm shall activate when the pressure is between 40 and 34 psi as indicated on the test gauge. | <ol style="list-style-type: none"> 6. If the alarm activates when the pressure is below 34 psi or above 40 psi, turn the adjustment wheel on the oxygen supply pressure switch, repeat the test and adjust as necessary to bring the set point into the correct range. 7. Close the oxygen flow control valve. 8. Allow pressure to drain from the system. 9. Close the flow control valve and turn the System Power switch to STANDBY. 10. Disconnect the test gauge and replace the plug in the tee fitting. |
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AIR CIRCUIT ADJUSTMENT AND TEST

Cylinder Pressure Regulator Adjustment

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| <ol style="list-style-type: none"> 1. Remove the plug from the tee fitting in the air cylinder pressure regulator output line, and connect a test gauge (#S000063) to the tee fitting. 2. Attach an air cylinder to the air yoke on the machine. 3. Connect AC power to the machine and turn the System Power switch to ON. 4. Set the Gas Select switch to the ALL GAS position. 5. Open the O₂ cylinder valve and set the oxygen flow rate to 4 l/min. | <ol style="list-style-type: none"> 6. Open the air cylinder valve and set the air flow rate to 4 l/min. 7. The test gauge should indicate between 43 and 49 psi. If adjustment is needed, remove the acorn nut from the bottom of the regulator to expose the adjusting screw. Turn the screw to bring the pressure reading into the correct range. Replace the acorn nut. 8. Close the cylinder valves and allow pressure to drain from the system. 9. Close the flow control valves and turn the System Power switch to STANDBY. 10. Disconnect the test gauge and replace the plug in the tee fitting. |
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AIR CIRCUIT ADJUSTMENT AND TEST (continued)
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High Pressure Leak Test

11. Open the cylinder valves and allow the gauge pressures to stabilize.
12. Close the cylinder valves and observe the cylinder pressure gauges. The pressure should not drop more than 50 psi over the next two minutes.

Low Pressure Leak Test

13. Open the flow control valves.
14. Connect a test gauge and B.P. bulb to the freshgas outlet, and pressurize the system to 50 cm H₂O.
15. The pressure should not drop more than 10 cm H₂O in thirty seconds.
16. Close the flow control valves and disconnect the test gauge.

OFPD Test

17. Turn the System Power switch to ON.
18. Open the O₂ and the air cylinder valves.
19. Set the oxygen flow rate to 1.0 l/min., and the air flow rate to 1.0 l/min.
20. Close the O₂ cylinder valve. When the oxygen flow stops, the air flow must also drop to zero.

Flowmeter Test

21. Open the O₂ cylinder valve, and open the O₂ flow control valve.
22. Adjust the flow of air over the full range of the flowmeters. The floats should move freely over their entire ranges.

Oxygen Concentration Test

23. Turn the System Power switch to ON.
24. Connect a 12 inch hose to the inspiratory valve.
25. Set the Man/Auto selector to BAG.
26. Close the APL valve.
27. Occlude the bag mount.
28. Insert the sensor from a calibrated O₂Med into the valve dome adapter on the inspiratory valve.
29. Press the O₂ Flush button for 15 seconds.
30. The O₂Med shall read 97-100% within three minutes.
31. Set the LOCK OUT device to ALL GASES.
32. Set the oxygen flow to 4 l/min.
33. Set the air flow to 2 l/min.
34. The oxygen concentration shall be 71-77%.
35. Close the air flow control valve.
36. Set the LOCK OUT device to O₂+N₂O.

AIR CIRCUIT ADJUSTMENT AND TEST (continued)
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ORMC Test

37. Fully open the N₂O flow control valve. Slowly open and close the O₂ flow control valve, and observe that the ORMC is controlling the flow of nitrous oxide. There should be no ORMC alarm with the Gas Select switch in the ALL GAS position.
38. Turn the Gas Select switch to O₂ + N₂O. Fully open the N₂O flow control valve. Slowly open and close the O₂ flow control valve, and observe that the ORMC is controlling the flow of nitrous oxide. The ORMC alarm should function correctly with the Gas Select switch in the O₂ + N₂O position.

Gas Select Switch Test

39. Open the N₂O cylinder valve.
40. With the switch in the ALL GAS position, open all of the flow control valves and observe that all gases are able to flow.
41. Turn the Gas Select switch to O₂ + N₂O. The flow of air should stop.
42. Close all of the flow control valves. There should be a minimum oxygen flow.
43. Turn the Gas Select switch to ALL GAS. The minimum oxygen flow should stop.

Re-Assembly

44. Close the cylinder valves and the flow control valves, and turn the System Power switch to STANDBY.
45. Ensure that the "off stop" is correctly set on the flow control valves, and install knob labels as needed.
46. Replace the table top on the machine.
47. Replace the vapor box back cover and the flowmeter housing back cover.
48. Perform a complete PMS on the machine.



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